

**APPENDIX IX.**

Serial No.: 09/520,032

Docket No.: 49933US031

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Amendment and Response filed December 27, 2001.

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IN THE UNITED STATES PATENT AND TRADEMARK OFFICE

Applicant(s):	HOOPMAN et al.	)	Group Art Unit:	1722
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Serial No.:	09/520,032	)	Examiner:	J. Leyson
Confirmation No.:	Unknown	)		
		)		
Filed:	6 March 2000	)		
		)		
For:	TOOLS TO MANUFACTURE ABRASIVE ARTICLES			

AMENDMENT AND RESPONSE

Assistant Commissioner for Patents  
Washington D.C. 20231

Dear Sir:

In response to the Office Action mailed 27 September 2001, please amend the above-identified application as follows:

In the Claims

Please amend claims 17, 20-21, 25-28, 33-54, 94-96, 98-111, and 133-175. The amended claims are provided below in clean form. Per 37 C.F.R. §1.121, amended claims are also shown in Appendix A with notations to indicate changes made (for convenience, all pending claims, including those added hereby, are provided in Appendix A).

17. (THRICE AMENDED) A production tool for manufacturing an abrasive article that comprises a major surface having deployed in fixed position thereon first and second three-dimensional abrasive composites, each of said composites comprising abrasive particles dispersed in a binder and having a shape defined by a substantially distinct and discernible boundary which includes substantially specific dimensions said first abrasive composite has a shape having specific first dimensions and said second abrasive composite has a second shape having second specific dimensions each of said abrasive composites has a boundary defined by at

least four planar surfaces adjacent planar surfaces of one composite meet at an edge to define an angle of intersection therebetween at least one angle of intersection of said first abrasive composite is different from all of the angles of intersection of said second composite, said production tool comprising a structure having a plurality of adjacent three-dimensional cavities form on a major surface thereof each three-dimensional cavity is defined by a substantially distinct and discernible boundary which includes substantially specific dimensions a first three-dimensional cavity has a first shape having specific first dimensions and a second three-dimensional cavity has a second shape having second specific dimensions each of said three-dimensional cavities has a boundary defined by at least four planar surfaces wherein adjacent planar surfaces of one three-dimensional cavity meet at an edge to define an angle of intersection therebetween at least one angle of intersection of said first three-dimensional cavity is different from all angles of intersection of said second three-dimensional cavity said three-dimensional cavities comprise pyramidal shapes each pyramidal shape comprises planar surfaces which intersect to form a material-included angle at a distal end of said pyramid, wherein said material-included angle is a value from 25° to 90°, and wherein each of the cavities has a single opening.

20. (THRICE AMENDED) A production tool for manufacturing an abrasive article that comprises a major surface having deployed in fixed position thereon first and second three-dimensional abrasive composites, each of said composites comprising abrasive particles dispersed in a binder and having a shape defined by a substantially distinct and discernible boundary which includes substantially specific dimensions said first abrasive composite has a shape having specific first dimensions and said second abrasive composite has a second shape having second specific dimensions each of said abrasive composites has a boundary defined by at least four planar surfaces wherein adjacent planar surfaces of one composite meet at an edge to define an angle of intersection therebetween at least one angle of intersection of said first abrasive composite is different from all of the angles of intersection of said second composite,

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said production tool comprising a structure having a plurality of adjacent three-dimensional cavities form on a major surface thereof each three-dimensional cavity is defined by a substantially distinct and discernible boundary which includes substantially specific dimensions a first three-dimensional cavity has a first shape having specific first dimensions and a second three-dimensional cavity has a second shape having second specific dimensions each of said three-dimensional cavities has a boundary defined by at least four planar surfaces wherein adjacent planar surfaces of one three-dimensional cavity meet at an edge to define an angle of intersection therebetween at least one angle of intersection of said first three-dimensional cavity is different from all angles of intersection of said second three-dimensional cavity, wherein the production tool is a roll, and wherein each of the cavities has a single opening.

21. (THRICE AMENDED) A production tool for manufacturing an abrasive article that comprises a major surface having deployed in fixed position thereon first and second three-dimensional abrasive composites, each of said composites comprising abrasive particles dispersed in a binder and having a shape defined by a substantially distinct and discernible boundary which includes substantially specific dimensions said first abrasive composite has a shape having specific first dimensions and said second abrasive composite has a second shape having second specific dimensions each of said abrasive composites has a boundary defined by at least four planar surfaces wherein adjacent planar surfaces of one composite meet at an edge to define an angle of intersection therebetween at least one angle of intersection of said first abrasive composite is different from all of the angles of intersection of said second composite, said production tool comprising a structure having a plurality of adjacent three-dimensional cavities form on a major surface thereof each three-dimensional cavity is defined by a substantially distinct and discernible boundary which includes substantially specific dimensions a first three-dimensional cavity has a first shape having specific first dimensions and a second three-dimensional cavity has a second shape having second specific dimensions each of said three-dimensional cavities has a boundary defined by at least four planar surfaces wherein

adjacent planar surfaces of one three-dimensional cavity meet at an edge to define an angle of intersection therebetween at least one angle of intersection of said first three-dimensional cavity is different from all angles of intersection of said second three-dimensional cavity, wherein the production tool is a coating roll, and wherein each of the cavities has a single opening.

25. (TWICE AMENDED) A production tool suitable for use in manufacturing an abrasive article comprising a plurality of cavities the cavities each have dimensions defining the cavity, wherein at least 10% of pairs of adjacent cavities have at least one dimension different between the two cavities of the pair, and wherein each of the cavities has a single opening.

26. (TWICE AMENDED) A production tool suitable for use in manufacturing an abrasive article comprising a plurality of cavities the cavities each have dimensions defining the cavity, wherein at least 30% of pairs of adjacent cavities have at least one dimension different between the two cavities of the pair, and wherein each of the cavities has a single opening.

27. (TWICE AMENDED) A production tool suitable for use in manufacturing an abrasive article comprising a plurality of cavities the cavities each have dimensions defining the cavity, wherein at least 50% of pairs of adjacent cavities have at least one dimension different between the two cavities of the pair, and wherein each of the cavities has a single opening.

28. (AMENDED) A production tool suitable for use in manufacturing an abrasive article comprising a plurality of cavities the cavities each have a geometric shape, dimensions defining the cavity, and angles forming the geometric shape the angles are different in at least two of the cavities, wherein at least 10% of pairs of adjacent cavities have at least one dimension different between the two cavities of the pair, and wherein each of the cavities has a single opening.

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33. (THRICE AMENDED) A production tool suitable for use in manufacturing an abrasive article comprising a first and second plurality of cavities the first plurality of cavities each have a first geometric shape and first plurality of angles forming the geometric shape and the second plurality of cavities each have a second geometric shape and second plurality of angles forming the geometric shape at least one of the angles of the first plurality is different from all of the angles of the second plurality of angles, wherein the production tool is a coating roll, and wherein each of the cavities has a single opening.

34. (THRICE AMENDED) A production tool suitable for use in manufacturing an abrasive article comprising a first, second, and third plurality of cavities the first plurality of cavities each have a first geometric shape and first plurality of angles forming the geometric shape, the second plurality of cavities each have a second geometric shape and second plurality of angles forming the geometric shape, and the third plurality of cavities each have a third geometric shape and third plurality of angles forming the geometric shape at least one of the angles of the first plurality is different from all of the angles of the second and third plurality of angles at least one of the angles of the second plurality is different from all of the angles of the first and third plurality of angles, wherein the production tool is a coating roll, and wherein each of the cavities has a single opening.

35. (THRICE AMENDED) A production tool suitable for use in manufacturing an abrasive article comprising a first, second, third, and fourth plurality of cavities the first plurality of cavities each have a first geometric shape and first plurality of angles forming the geometric shape, the second plurality of cavities each have a second geometric shape and second plurality of angles forming the geometric shape, the third plurality of cavities each have a third geometric shape and third plurality of angles forming the geometric shape, and the fourth plurality of cavities each have a fourth geometric shape and fourth plurality of angles forming the geometric shape at least one of the angles of the first plurality is different from all of the angles of the second, third, and fourth plurality of angles at least one of the angles of the second plurality is different from all of the angles of the

first, third, and fourth plurality of angles at least one of the angles of the third plurality is different from all of the angles of the first, second, and fourth plurality of angles, wherein the production tool is a coating roll, and wherein each of the cavities has a single opening.

36. (THRICE AMENDED) A production tool suitable for use in manufacturing an abrasive article comprising a plurality of cavities the cavities each have dimensions defining the cavity at least 10% of pairs of adjacent cavities have at least one dimension different between the two cavities of the pair, wherein the production tool is a coating roll, and wherein each of the cavities has a single opening.

37. (THRICE AMENDED) A production tool suitable for use in manufacturing an abrasive article comprising a plurality of cavities the cavities each have dimensions defining the cavity at least 30% of pairs of adjacent cavities have at least one dimension different between the two cavities of the pair, wherein the production tool is a coating roll, and wherein each of the cavities has a single opening.

38. (THRICE AMENDED) A production tool suitable for use in manufacturing an abrasive article comprising a plurality of cavities the cavities each have dimensions defining the cavity at least 50% of pairs of adjacent cavities have at least one dimension different between the two cavities of the pair, wherein the production tool is a coating roll, and wherein each of the cavities has a single opening.

39. (THRICE AMENDED) A production tool suitable for use in manufacturing an abrasive article comprising a plurality of cavities the cavities each have a geometric shape, dimensions defining the cavity, and angles forming the geometric shape the angles are different in at least two of the cavities at least 10% of pairs of adjacent cavities have at least one dimension different between the

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two cavities of the pair, wherein the production tool is a coating roll, and wherein each of the cavities has a single opening.

40. (THRICE AMENDED) A production tool suitable for use in manufacturing an abrasive article comprising a plurality of cavities the cavities each have dimensions defining the cavity at least two adjacent cavities have at least one dimension different between the two cavities, wherein the production tool is a coating, and wherein each of the cavities has a single opening.

41. (THRICE AMENDED) A production tool suitable for use in manufacturing an abrasive article comprising a plurality of cavities defining at least a first and a second group a first group of cavities has a first shape and a second group of cavities has a second, different, shape, wherein the production tool is a coating roll, and wherein each of the cavities has a single opening.

42. (THRICE AMENDED) A production tool suitable for use in manufacturing an abrasive article comprising a plurality of cavities defining at least a first and a second group a first group of cavities has a first size and a second group of cavities has a second, different, size, wherein the production tool is a coating roll, and wherein each of the cavities has a single opening.

43. (THRICE AMENDED) A production tool suitable for use in manufacturing an abrasive article comprising a plurality of cavities defined by substantially distinct and discernible boundaries which include substantially specific dimensions a first cavity has specific first dimensions and a second cavity has specific second dimensions, each of said cavities has a boundary defined by at least four planar surfaces wherein adjacent planar surfaces of one cavity meet at an edge to define an angle of intersection therebetween at least one angle of intersection of said first cavity is different from all the angles of intersection of said second cavity, wherein the production tool is a coating roll, and wherein each of the cavities has a single opening.

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44. (THRICE AMENDED) A production tool suitable for use in manufacturing an abrasive article comprising a first and second plurality of cavities the first plurality of cavities each have a first geometric shape and first plurality of angles forming the geometric shape and the second plurality of cavities each have a second geometric shape and second plurality of angles forming the geometric shape at least one of the angles of the first plurality is different from all of the angles of the second plurality of angles, wherein the production tool is an engraved metal roll, and wherein each of the cavities has a single opening.

45. (THRICE AMENDED) A production tool suitable for use in manufacturing an abrasive article comprising a first, second, and third plurality of cavities the first plurality of cavities each have a first geometric shape and first plurality of angles forming the geometric shape, the second plurality of cavities each have a second geometric shape and second plurality of angles forming the geometric shape, and the third plurality of cavities each have a third geometric shape and third plurality of angles forming the geometric shape at least one of the angles of the first plurality is different from all of the angles of the second and third plurality of angles at least one of the angles of the second plurality is different from all of the angles of the first and third plurality of angles, wherein the production tool is an engraved metal roll, and wherein each of the cavities has a single opening.

46. (THRICE AMENDED) A production tool suitable for use in manufacturing an abrasive article comprising a first, second, third, and fourth plurality of cavities the first plurality of cavities each have a first geometric shape and first plurality of angles forming the geometric shape, the second plurality of cavities each have a second geometric shape and second plurality of angles forming the geometric shape, the third plurality of cavities each have a third geometric shape and third plurality of angles forming the geometric shape, and the fourth plurality of cavities each have a fourth geometric shape and fourth plurality of angles forming the geometric shape at least one of the angles of the first plurality is different from all of the angles of the second, third, and fourth plurality of angles at least one of the angles of the second plurality is different from all of the angles of the

first, third, and fourth plurality of angles at least one of the angles of the third plurality is different from all of the angles of the first, second, and fourth plurality of angles, wherein the production tool is an engraved metal roll, and wherein each of the cavities has a single opening.

47. (THRICE AMENDED) A production tool suitable for use in manufacturing an abrasive article comprising a plurality of cavities the cavities each have dimensions defining the cavity at least 10% of pairs of adjacent cavities have at least one dimension different between the two cavities of the pair, wherein the production tool is an engraved metal roll, and wherein each of the cavities has a single opening.

48. (THRICE AMENDED) A production tool suitable for use in manufacturing an abrasive article comprising a plurality of cavities the cavities each have dimensions defining the cavity at least 30% of pairs of adjacent cavities have at least one dimension different between the two cavities of the pair, wherein the production tool is an engraved metal roll, and wherein each of the cavities has a single opening.

49. (THRICE AMENDED) A production tool suitable for use in manufacturing an abrasive article comprising a plurality of cavities the cavities each have dimensions defining the cavity at least 50% of pairs of adjacent cavities have at least one dimension different between the two cavities of the pair, wherein the production tool is an engraved metal roll, and wherein each of the cavities has a single opening.

50. (THRICE AMENDED) A production tool suitable for use in manufacturing an abrasive article comprising a plurality of cavities the cavities each have a geometric shape, dimensions defining the cavity, and angles forming the geometric shape the angles are different in at least two of the cavities at least 10% of pairs of adjacent cavities have at least one dimension different between the

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two cavities of the pair, wherein the production tool is an engraved metal roll, and wherein each of the cavities has a single opening.

51. (THRICE AMENDED) A production tool suitable for use in manufacturing an abrasive article comprising a plurality of cavities the cavities each have dimensions defining the cavity at least two adjacent cavities have at least one dimension different between the two cavities, wherein the production tool is an engraved metal roll, and wherein each of the cavities has a single opening.

52. (THRICE AMENDED) A production tool suitable for use in manufacturing an abrasive article comprising a plurality of cavities defining at least a first and a second group a first group of cavities has a first shape and a second group of cavities has a second, different, shape, wherein the production tool is an engraved metal roll, and wherein each of the cavities has a single opening.

53. (THRICE AMENDED) A production tool suitable for use in manufacturing an abrasive article comprising a plurality of cavities defining at least a first and a second group a first group of cavities has a first size and a second group of cavities has a second, different, size, wherein the production tool is an engraved metal roll, and wherein each of the cavities has a single opening.

54. (THRICE AMENDED) A production tool suitable for use in manufacturing an abrasive article comprising a plurality of cavities defined by substantially distinct and discernible boundaries which include substantially specific dimensions a first cavity has specific first dimensions and a second cavity has specific second dimensions, each of said cavities has a boundary defined by at least four planar surfaces adjacent planar surfaces of one cavity meet at an edge to define an angle of intersection therebetween at least one angle of intersection of said first cavity is different from all the angles of intersection of said second cavity, wherein the production tool is an engraved metal roll, and wherein each of the cavities has a single opening.

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94. (TWICE AMENDED) A production tool suitable for use in manufacturing an abrasive article comprising a plurality of cavities the cavities each have dimensions defining the cavity, the dimensions including base edge lengths, wherein at least 10% of pairs of adjacent cavities have at least one base edge length different between the two cavities of the pair, and wherein each of the cavities has a single opening.

95. (TWICE AMENDED) A production tool suitable for use in manufacturing an abrasive article comprising a plurality of cavities the cavities each have dimensions defining the cavity, the dimensions including base edge lengths, wherein at least 30% of pairs of adjacent cavities have at least one base edge length different between the two cavities of the pair, and wherein each of the cavities has a single opening.

96. (TWICE AMENDED) A production tool suitable for use in manufacturing an abrasive article comprising a plurality of cavities the cavities each have dimensions defining the cavity, the dimensions including base edge lengths, wherein at least 50% of pairs of adjacent cavities have at least one base edge length different between the two cavities of the pair, and wherein each of the cavities has a single opening.

98. (THRICE AMENDED) A production tool suitable for use in manufacturing an abrasive article comprising a first and second plurality of cavities the first plurality of cavities each have a first geometric shape including a base and first plurality of base edge lengths forming the base of the geometric shape and the second plurality of cavities each have a second geometric shape including a base and second plurality of base edge lengths forming the base of the geometric shape at least one of the base edge lengths of the first plurality is different from all of the base edge lengths of the second plurality of base edge lengths, wherein the production tool is a coating roll, and wherein each of the cavities has a single opening.

99. (THRICE AMENDED) A production tool suitable for use in manufacturing an abrasive article comprising a first, second, and third plurality of cavities the first plurality of cavities each have a first geometric shape including a base and first plurality of base edge lengths forming the base of the geometric shape, the second plurality of cavities each have a second geometric shape including a base and second plurality of base edge lengths forming the base of the geometric shape, and the third plurality of cavities each have a third geometric shape including a base and third plurality of base edge lengths forming the base of the geometric shape at least one of the base edge lengths of the first plurality is different from all of the base edge lengths of the second and third plurality of base edge lengths at least one of the base edge lengths of the second plurality is different from all of the base edge lengths of the first and third plurality of base edge lengths, wherein the production tool is a coating roll, and wherein each of the cavities has a single opening.

100. (THRICE AMENDED) A production tool suitable for use in manufacturing an abrasive article comprising a first, second, third, and fourth plurality of cavities the first plurality of cavities each have a first geometric shape including a base and first plurality of base edge lengths forming the base of the geometric shape, the second plurality of cavities each have a second geometric shape including a base and second plurality of base edge lengths forming the base of the geometric shape, the third plurality of cavities each have a third geometric shape including a base and third plurality of base edge lengths forming the base of the geometric shape, and the fourth plurality of cavities each have a fourth geometric shape including a base and fourth plurality of base edge lengths forming the base of the geometric shape at least one of the base edge lengths of the first plurality is different from all of the base edge lengths of the second, third, and fourth plurality of base edge lengths at least one of the base edge lengths of the second plurality is different from all of the base edge lengths of the first, third, and fourth plurality of base edge lengths at least one of the base edge lengths of the third plurality is different from all of the base edge lengths of the first, second, and fourth plurality of base edge lengths, wherein the production tool is a coating roll, and wherein each of the cavities has a single opening.

101. (THRICE AMENDED) A production tool suitable for use in manufacturing an abrasive article comprising a plurality of cavities the cavities each have dimensions defining the cavity, the dimensions including base edge lengths at least 10% of pairs of adjacent cavities have at least one base edge length different between the two cavities of the pair, wherein the production tool is a coating roll, and wherein each of the cavities has a single opening.

102. (THRICE AMENDED) A production tool suitable for use in manufacturing an abrasive article comprising a plurality of cavities the cavities each have dimensions defining the cavity, the dimensions including base edge lengths at least 30% of pairs of adjacent cavities have at least one base edge length different between the two cavities of the pair, wherein the production tool is a coating roll, and wherein each of the cavities has a single opening.

103. (THRICE AMENDED) A production tool suitable for use in manufacturing an abrasive article comprising a plurality of cavities the cavities each have dimensions defining the cavity, the dimensions including base edge lengths at least 50% of pairs of adjacent cavities have at least one base edge length different between the two cavities of the pair, wherein the production tool is a coating roll, and wherein each of the cavities has a single opening.

104. (THRICE AMENDED) A production tool suitable for use in manufacturing an abrasive article comprising a plurality of cavities the cavities each have dimensions defining the cavity, the dimensions including base edge lengths at least two adjacent cavities have at least one base edge length different between the two cavities, wherein the production tool is a coating roll, and wherein each of the cavities has a single opening.

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105. (THRICE AMENDED) A production tool suitable for use in manufacturing an abrasive article comprising a first and second plurality of cavities the first plurality of cavities each have a

first geometric shape including a base and first plurality of base edge lengths forming the base of the geometric shape and the second plurality of cavities each have a second geometric shape including a base and second plurality of base edge lengths forming the base of the geometric shape at least one of the base edge lengths of the first plurality is different from all of the base edge lengths of the second plurality of base edge lengths, wherein the production tool is an engraved metal roll, and wherein each of the cavities has a single opening.

106. (THRICE AMENDED) A production tool suitable for use in manufacturing an abrasive article comprising a first, second, and third plurality of cavities the first plurality of cavities each have a first geometric shape including a base and first plurality of base edge lengths forming the base of the geometric shape, the second plurality of cavities each have a second geometric shape including a base and second plurality of base edge lengths forming the base of the geometric shape, and the third plurality of cavities each have a third geometric shape including a base and third plurality of base edge lengths forming the base of the geometric shape at least one of the base edge lengths of the first plurality is different from all of the base edge lengths of the second and third plurality of base edge lengths at least one of the base edge lengths of the second plurality is different from all of the base edge lengths of the first and third plurality of base edge lengths, wherein the production tool is an engraved metal roll, and wherein each of the cavities has a single opening.

107. (THRICE AMENDED) A production tool suitable for use in manufacturing an abrasive article comprising a first, second, third, and fourth plurality of cavities the first plurality of cavities each have a first geometric shape including a base and first plurality of base edge lengths forming the base of the geometric shape, the second plurality of cavities each have a second geometric shape including a base and second plurality of base edge lengths forming the base of the geometric shape, the third plurality of cavities each have a third geometric shape including a base and third plurality of base edge lengths forming the base of the geometric shape, and the fourth plurality of cavities each have a fourth geometric shape including a base and fourth plurality of base edge lengths forming the

base of the geometric shape at least one of the base edge lengths of the first plurality is different from all of the base edge lengths of the second, third, and fourth plurality of base edge lengths at least one of the base edge lengths of the second plurality is different from all of the base edge lengths of the first, third, and fourth plurality of base edge lengths at least one of the base edge lengths of the third plurality is different from all of the base edge lengths of the first, second, and fourth plurality of base edge lengths, wherein the production tool is an engraved metal roll, and wherein each of the cavities has a single opening.

108. (THRICE AMENDED) A production tool suitable for use in manufacturing an abrasive article comprising a plurality of cavities the cavities each have dimensions defining the cavity, the dimensions including base edge lengths at least 10% of pairs of adjacent cavities have at least one base edge length different between the two cavities of the pair, wherein the production tool is an engraved metal roll, and wherein each of the cavities has a single opening.

109. (THRICE AMENDED) A production tool suitable for use in manufacturing an abrasive article comprising a plurality of cavities the cavities each have dimensions defining the cavity, the dimensions including base edge lengths at least 30% of pairs of adjacent cavities have at least one base edge length different between the two cavities of the pair, wherein the production tool is an engraved metal roll, and wherein each of the cavities has a single opening.

110. (THRICE AMENDED) A production tool suitable for use in manufacturing an abrasive article comprising a plurality of cavities the cavities each have dimensions defining the cavity, the dimensions including base edge lengths at least 50% of pairs of adjacent cavities have at least one base edge length different between the two cavities of the pair, wherein the production tool is an engraved metal roll, and wherein each of the cavities has a single opening.

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111. (THRICE AMENDED) A production tool suitable for use in manufacturing an abrasive article comprising a plurality of cavities the cavities each have dimensions defining the cavity, the dimensions including base edge lengths at least two adjacent cavities have at least one base edge length different between the two cavities, wherein the production tool is an engraved metal roll, and wherein each of the cavities has a single opening.

133. (AMENDED) A method of making a production tool, the method comprising:  
creating a design for a production tool for manufacturing an abrasive article, the production tool comprising a plurality of cavities the cavities each have dimensions defining the cavity, wherein at least 10% of pairs of adjacent cavities have at least one dimension different between the two cavities of the pair, and wherein each of the cavities has a single opening; and  
forming the production tool using the design.

134. (AMENDED) A method of making a production tool, the method comprising:  
creating a design for a production tool for manufacturing an abrasive article, the production tool comprising a plurality of cavities the cavities each have dimensions defining the cavity, wherein at least 30% of pairs of adjacent cavities have at least one dimension different between the two cavities of the pair, and wherein each of the cavities has a single opening; and  
forming the production tool using the design.

135. (AMENDED) A method of making a production tool, the method comprising:  
creating a design for a production tool for manufacturing an abrasive article, the production tool comprising a plurality of cavities the cavities each have dimensions defining the cavity, wherein at least 50% of pairs of adjacent cavities have at least one dimension different between the two cavities of the pair, and wherein each of the cavities has a single opening; and  
forming the production tool using the design.

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136. (AMENDED) A method of making a production tool, the method comprising:

creating a design for a production tool for manufacturing an abrasive article, the production tool comprising a plurality of cavities the cavities each have a geometric shape, dimensions defining the cavity, and angles forming the geometric shape the angles are different in at least two of the cavities, wherein at least 10% of pairs of adjacent cavities have at least one dimension different between the two cavities of the pair, and wherein each of the cavities has a single opening; and forming the production tool using the design.

137. (AMENDED) A method of making a production tool, the method comprising:

creating a design for a production tool for manufacturing an abrasive article, the production tool comprising a first and second plurality of cavities the first plurality of cavities each have a first geometric shape and first plurality of angles forming the geometric shape and the second plurality of cavities each have a second geometric shape and second plurality of angles forming the geometric shape at least one of the angles of the first plurality is different from all of the angles of the second plurality of angles, wherein the production tool is a coating roll, and wherein each of the cavities has a single opening; and

forming the production tool using the design.

138. (AMENDED) A method of making a production tool, the method comprising:

creating a design for a production tool for manufacturing an abrasive article, the production tool comprising a first, second, and third plurality of cavities the first plurality of cavities each have a first geometric shape and first plurality of angles forming the geometric shape, the second plurality of cavities each have a second geometric shape and second plurality of angles forming the geometric shape, and the third plurality of cavities each have a third geometric shape and third plurality of angles forming the geometric shape at least one of the angles of the first plurality is different from all of the angles of the second and third plurality of angles at least one of the angles of the second

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plurality is different from all of the angles of the first and third plurality of angles, wherein the production tool is a coating roll, and wherein each of the cavities has a single opening; and forming the production tool using the design.

139. (AMENDED) A method of making a production tool, the method comprising:

creating a design for a production tool for manufacturing an abrasive article, the production tool comprising a first, second, third, and fourth plurality of cavities the first plurality of cavities each have a first geometric shape and first plurality of angles forming the geometric shape, the second plurality of cavities each have a second geometric shape and second plurality of angles forming the geometric shape, the third plurality of cavities each have a third geometric shape and third plurality of angles forming the geometric shape, and the fourth plurality of cavities each have a fourth geometric shape and fourth plurality of angles forming the geometric shape at least one of the angles of the first plurality is different from all of the angles of the second, third, and fourth plurality of angles at least one of the angles of the second plurality is different from all of the angles of the first, third, and fourth plurality of angles at least one of the angles of the third plurality is different from all of the angles of the first, second, and fourth plurality of angles, wherein the production tool is a coating roll, and wherein each of the cavities has a single opening; and forming the production tool using the design.

140. (AMENDED) A method of making a production tool, the method comprising:

creating a design for a production tool for manufacturing an abrasive article, the production tool comprising a plurality of cavities the cavities each have dimensions defining the cavity at least 10% of pairs of adjacent cavities have at least one dimension different between the two cavities of the pair, wherein the production tool is a coating roll, and wherein each of the cavities has a single opening; and

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forming the production tool using the design.

141. (AMENDED) A method of making a production tool, the method comprising:

creating a design for a production tool for manufacturing an abrasive article, the production tool comprising a plurality of cavities the cavities each have dimensions defining the cavity at least 30% of pairs of adjacent cavities have at least one dimension different between the two cavities of the pair, wherein the production tool is a coating roll, and wherein each of the cavities has a single opening; and

forming the production tool using the design.

142. (AMENDED) A method of making a production tool, the method comprising:

creating a design for a production tool for manufacturing an abrasive article, the production tool comprising a plurality of cavities the cavities each have dimensions defining the cavity at least 50% of pairs of adjacent cavities have at least one dimension different between the two cavities of the pair, wherein the production tool is a coating roll, and wherein each of the cavities has a single opening; and

forming the production tool using the design.

143. (AMENDED) A method of making a production tool, the method comprising:

creating a design for a production tool for manufacturing an abrasive article, the production tool comprising a plurality of cavities the cavities each have a geometric shape, dimensions defining the cavity, and angles forming the geometric shape the angles are different in at least two of the cavities at least 10% of pairs of adjacent cavities have at least one dimension different between the two cavities of the pair, wherein the production tool is a coating roll, and wherein each of the cavities has a single opening; and

forming the production tool using the design.

~~144. (AMENDED) A method of making a production tool, the method comprising:~~

~~creating a design for a production tool for manufacturing an abrasive article, the production~~

tool comprising a plurality of cavities the cavities each have dimensions defining the cavity at least two adjacent cavities have at least one dimension different between the two cavities, wherein the production tool is a coating roll, and wherein each of the cavities has a single opening; and forming the production tool using the design.

145. (AMENDED) A method of making a production tool, the method comprising:  
creating a design for a production tool for manufacturing an abrasive article, the production tool comprising a plurality of cavities defining at least a first and a second group a first group of cavities has a first shape and a second group of cavities has a second, different, shape, wherein the production tool is a coating roll, and wherein each of the cavities has a single opening; and forming the production tool using the design.

146. (AMENDED) A method of making a production tool, the method comprising:  
creating a design for a production tool for manufacturing an abrasive article, the production tool comprising a plurality of cavities defining at least a first and a second group a first group of cavities has a first size and a second group of cavities has a second, different, size, wherein the production tool is a coating roll, and wherein each of the cavities has a single opening; and forming the production tool using the design.

147. (AMENDED) A method of making a production tool, the method comprising:  
creating a design for a production tool for manufacturing an abrasive article, the production tool comprising a plurality of cavities defined by substantially distinct and discernible boundaries which include substantially specific dimensions a first cavity has specific first dimensions and a second cavity has specific second dimensions, each of said cavities has a boundary defined by at least four planar surfaces adjacent planar surfaces of one cavity meet at an edge to define an angle of intersection therebetween at least one angle of intersection of said first cavity is different from all the

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angles of intersection of said second cavity, wherein the production tool is a coating roll, and wherein each of the cavities has a single opening; and

forming the production tool using the design.

148. (AMENDED) A method of making a production tool, the method comprising:

creating a design for a production tool for manufacturing an abrasive article, the production tool comprising a first and second plurality of cavities the first plurality of cavities each have a first geometric shape and first plurality of angles forming the geometric shape and the second plurality of cavities each have a second geometric shape and second plurality of angles forming the geometric shape at least one of the angles of the first plurality is different from all of the angles of the second plurality of angles, wherein the production tool is an engraved metal roll, and wherein each of the cavities has a single opening; and

forming the production tool using the design.

149. (AMENDED) A method of making a production tool, the method comprising:

creating a design for a production tool for manufacturing an abrasive article, the production tool comprising a first, second, and third plurality of cavities the first plurality of cavities each have a first geometric shape and first plurality of angles forming the geometric shape, the second plurality of cavities each have a second geometric shape and second plurality of angles forming the geometric shape, and the third plurality of cavities each have a third geometric shape and third plurality of angles forming the geometric shape at least one of the angles of the first plurality is different from all of the angles of the second and third plurality of angles at least one of the angles of the second plurality is different from all of the angles of the first and third plurality of angles, wherein the production tool is an engraved metal roll, and wherein each of the cavities has a single opening; and

forming the production tool using the design.

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150. (AMENDED) A method of making a production tool, the method comprising:

creating a design for a production tool for manufacturing an abrasive article, the production tool comprising a first, second, third, and fourth plurality of cavities the first plurality of cavities each have a first geometric shape and first plurality of angles forming the geometric shape, the second plurality of cavities each have a second geometric shape and second plurality of angles forming the geometric shape, the third plurality of cavities each have a third geometric shape and third plurality of angles forming the geometric shape, and the fourth plurality of cavities each have a fourth geometric shape and fourth plurality of angles forming the geometric shape at least one of the angles of the first plurality is different from all of the angles of the second, third, and fourth plurality of angles at least one of the angles of the second plurality is different from all of the angles of the first, third, and fourth plurality of angles at least one of the angles of the third plurality is different from all of the angles of the first, second, and fourth plurality of angles, wherein the production tool is an engraved metal roll, and wherein each of the cavities has a single opening; and forming the production tool using the design.

151. (AMENDED) A method of making a production tool, the method comprising:

creating a design for a production tool for manufacturing an abrasive article, the production tool comprising a plurality of cavities the cavities each have dimensions defining the cavity at least 10% of pairs of adjacent cavities have at least one dimension different between the two cavities of the pair, wherein the production tool is an engraved metal roll, and wherein each of the cavities has a single opening; and

forming the production tool using the design.

152. (AMENDED) A method of making a production tool, the method comprising:

creating a design for a production tool for manufacturing an abrasive article, the production tool comprising a plurality of cavities the cavities each have dimensions defining the cavity at least

~~30% of pairs of adjacent cavities have at least one dimension different between the two cavities of the~~

pair, wherein the production tool is an engraved metal roll, and wherein each of the cavities has a single opening; and

forming the production tool using the design.

153. (AMENDED) A method of making a production tool, the method comprising:

creating a design for a production tool for manufacturing an abrasive article, the production tool comprising a plurality of cavities the cavities each have dimensions defining the cavity at least 50% of pairs of adjacent cavities have at least one dimension different between the two cavities of the pair, wherein the production tool is an engraved metal roll, and wherein each of the cavities has a single opening; and

forming the production tool using the design.

154. (AMENDED) A method of making a production tool, the method comprising:

creating a design for a production tool for manufacturing an abrasive article, the production tool comprising a plurality of cavities the cavities each have a geometric shape, dimensions defining the cavity, and angles forming the geometric shape the angles are different in at least two of the cavities at least 10% of pairs of adjacent cavities have at least one dimension different between the two cavities of the pair, wherein the production tool is an engraved metal roll, and wherein each of the cavities has a single opening; and

forming the production tool using the design.

155. (AMENDED) A method of making a production tool, the method comprising:

creating a design for a production tool for manufacturing an abrasive article, the production tool comprising a plurality of cavities the cavities each have dimensions defining the cavity at least two adjacent cavities have at least one dimension different between the two cavities, wherein the production tool is an engraved metal roll, and wherein each of the cavities has a single opening; and

forming the production tool using the design.

156. (AMENDED) A method of making a production tool, the method comprising:

creating a design for a production tool for manufacturing an abrasive article, the production tool comprising a plurality of cavities defining at least a first and a second group a first group of cavities has a first shape and a second group of cavities has a second, different, shape, wherein the production tool is an engraved metal roll, and wherein each of the cavities has a single opening; and forming the production tool using the design.

157. (AMENDED) A method of making a production tool, the method comprising:

creating a design for a production tool for manufacturing an abrasive article, the production tool comprising a plurality of cavities defining at least a first and a second group a first group of cavities has a first size and a second group of cavities has a second, different, size, wherein the production tool is an engraved metal roll, and wherein each of the cavities has a single opening; and forming the production tool using the design.

158. (AMENDED) A method of making a production tool, the method comprising:

creating a design for a production tool for manufacturing an abrasive article, the production tool comprising a plurality of cavities defined by substantially distinct and discernible boundaries which include substantially specific dimensions a first cavity has specific first dimensions and a second cavity has specific second dimensions, each of said cavities has a boundary defined by at least four planar surfaces wherein adjacent planar surfaces of one cavity meet at an edge to define an angle of intersection therebetween at least one angle of intersection of said first cavity is different from all the angles of intersection of said second cavity, wherein the production tool is an engraved metal roll, and wherein each of the cavities has a single opening; and forming the production tool using the design.

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159. (AMENDED) A methods of making a production tool, the method comprising:

creating a design for a production tool for manufacturing an abrasive article, the production tool comprising a plurality of cavities the cavities each have dimensions defining the cavity, the dimensions including base edge lengths, wherein at least 10% of pairs of adjacent cavities have at least one base edge length different between the two cavities of the pair, and wherein each of the cavities has a single opening; and

forming the production tool using the design.

160. (AMENDED) A method of making a production tool, the method comprising:

creating a design for a production tool for manufacturing an abrasive article, the production tool comprising a plurality of cavities a plurality of cavities the cavities each have dimensions defining the cavity, the dimensions including base edge lengths, wherein at least 30% of pairs of adjacent cavities have at least one base edge length different between the two cavities of the pair, and wherein each of the cavities has a single opening; and

forming the production tool using the design.

161. (AMENDED) A method of making a production tool, the method comprising:

creating a design for a production tool for manufacturing an abrasive article, the production tool comprising a plurality of cavities the cavities each have dimensions defining the cavity, the dimensions including base edge lengths, wherein at least 50% of pairs of adjacent cavities have at least one base edge length different between the two cavities of the pair, and wherein each of the cavities has a single opening; and

forming the production tool using the design.

162. (AMENDED) A method of making a production tool, the method comprising:

creating a design for a production tool for manufacturing an abrasive article, the production tool comprising a first and second plurality of cavities the first plurality of cavities each have a first geometric shape including a base and first plurality of base edge lengths forming the base of the

geometric shape and the second plurality of cavities each have a second geometric shape including a base and second plurality of base edge lengths forming the base of the geometric shape at least one of the base edge lengths of the first plurality is different from all of the base edge lengths of the second plurality of base edge lengths, wherein the production tool is a coating roll, and wherein each of the cavities has a single opening; and

forming the production tool using the design.

163. (AMENDED) A method of making a production tool, the method comprising:

creating a design for a production tool for manufacturing an abrasive article, the production tool comprising a first, second, and third plurality of cavities the first plurality of cavities each have a first geometric shape including a base and first plurality of base edge lengths forming the base of the geometric shape, the second plurality of cavities each have a second geometric shape including a base and second plurality of base edge lengths forming the base of the geometric shape, and the third plurality of cavities each have a third geometric shape including a base and third plurality of base edge lengths forming the base of the geometric shape at least one of the base edge lengths of the first plurality is different from all of the base edge lengths of the second and third plurality of base edge lengths at least one of the base edge lengths of the second plurality is different from all of the base edge lengths of the first and third plurality of base edge lengths, wherein the production tool is a coating roll, and wherein each of the cavities has a single opening; and

forming the production tool using the design.

164. (AMENDED) A method of making a production tool, the method comprising:

creating a design for a production tool for manufacturing an abrasive article, the production tool comprising a first, second, third, and fourth plurality of cavities the first plurality of cavities each have a first geometric shape including a base and first plurality of base edge lengths forming the base of the geometric shape, the second plurality of cavities each have a second geometric shape including a base and second plurality of base edge lengths forming the base of the geometric shape,

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the third plurality of cavities each have a third geometric shape including a base and third plurality of base edge lengths forming the base of the geometric shape, and the fourth plurality of cavities each have a fourth geometric shape including a base and fourth plurality of base edge lengths forming the base of the geometric shape at least one of the base edge lengths of the first plurality is different from all of the base edge lengths of the second, third, and fourth plurality of base edge lengths at least one of the base edge lengths of the second plurality is different from all of the base edge lengths of the first, third, and fourth plurality of base edge lengths at least one of the base edge lengths of the third plurality is different from all of the base edge lengths of the first, second, and fourth plurality of base edge lengths, wherein the production tool is a coating roll, and wherein each of the cavities has a single opening; and

forming the production tool using the design.

165. (AMENDED) A method of making a production tool, the method comprising:

creating a design for a production tool for manufacturing an abrasive article, the production tool comprising a plurality of cavities the cavities each have dimensions defining the cavity, the dimensions including base edge lengths at least 10% of pairs of adjacent cavities have at least one base edge length different between the two cavities of the pair, wherein the production tool is a coating roll, and wherein each of the cavities has a single opening; and

forming the production tool using the design.

166. (AMENDED) A method of making a production tool, the method comprising:

creating a design for a production tool for manufacturing an abrasive article, the production tool comprising a plurality of cavities the cavities each have dimensions defining the cavity, the dimensions including base edge lengths at least 30% of pairs of adjacent cavities have at least one base edge length different between the two cavities of the pair, wherein the production tool is a coating roll, and wherein each of the cavities has a single opening; and

forming the production tool using the design.

167. (AMENDED) A method of making a production tool, the method comprising:

creating a design for a production tool for manufacturing an abrasive article, the production tool comprising a plurality of cavities the cavities each have dimensions defining the cavity, the dimensions including base edge lengths at least 50% of pairs of adjacent cavities have at least one base edge length different between the two cavities of the pair, wherein the production tool is a coating roll, and wherein each of the cavities has a single opening; and

forming the production tool using the design.

168. (AMENDED) A method of making a production tool, the method comprising:

creating a design for a production tool for manufacturing an abrasive article, the production tool comprising a plurality of cavities the cavities each have dimensions defining the cavity, the dimensions including base edge lengths at least two adjacent cavities have at least one base edge length different between the two cavities, wherein the production tool is a coating roll, and wherein each of the cavities has a single opening; and

forming the production tool using the design.

169. (AMENDED) A method of making a production tool, the method comprising:

creating a design for a production tool for manufacturing an abrasive article, the production tool comprising a first and second plurality of cavities the first plurality of cavities each have a first geometric shape including a base and first plurality of base edge lengths forming the base of the geometric shape and the second plurality of cavities each have a second geometric shape including a base and second plurality of base edge lengths forming the base of the geometric shape at least one of the base edge lengths of the first plurality is different from all of the base edge lengths of the second plurality of base edge lengths, wherein the production tool is an engraved metal roll, and wherein each of the cavities has a single opening; and

forming the production tool using the design.

170. (AMENDED) A method of making a production tool, the method comprising:

creating a design for a production tool for manufacturing an abrasive article, the production tool comprising a first, second, and third plurality of cavities the first plurality of cavities each have a first geometric shape including a base and first plurality of base edge lengths forming the base of the geometric shape, the second plurality of cavities each have a second geometric shape including a base and second plurality of base edge lengths forming the base of the geometric shape, and the third plurality of cavities each have a third geometric shape including a base and third plurality of base edge lengths forming the base of the geometric shape at least one of the base edge lengths of the first plurality is different from all of the base edge lengths of the second and third plurality of base edge lengths at least one of the base edge lengths of the second plurality is different from all of the base edge lengths of the first and third plurality of base edge lengths, wherein the production tool is an engraved metal roll, and wherein each of the cavities has a single opening; and  
forming the production tool using the design.

171. (AMENDED) A method of making a production tool, the method comprising:

creating a design for a production tool for manufacturing an abrasive article, the production tool comprising a first, second, third, and fourth plurality of cavities the first plurality of cavities each have a first geometric shape including a base and first plurality of base edge lengths forming the base of the geometric shape, the second plurality of cavities each have a second geometric shape including a base and second plurality of base edge lengths forming the base of the geometric shape, the third plurality of cavities each have a third geometric shape including a base and third plurality of base edge lengths forming the base of the geometric shape, and the fourth plurality of cavities each have a fourth geometric shape including a base and fourth plurality of base edge lengths forming the base of the geometric shape at least one of the base edge lengths of the first plurality is different from all of the base edge lengths of the second, third, and fourth plurality of base edge lengths at least one of the base edge lengths of the second plurality is different from all of the base edge lengths of the

first, third, and fourth plurality of base edge lengths at least one of the base edge lengths of the third plurality is different from all of the base edge lengths of the first, second, and fourth plurality of base edge lengths, wherein the production tool is an engraved metal roll, and wherein each of the cavities has a single opening; and

forming the production tool using the design.

172. (AMENDED) A method of making a production tool, the method comprising:

creating a design for a production tool for manufacturing an abrasive article, the production tool comprising a plurality of cavities the cavities each have dimensions defining the cavity, the dimensions including base edge lengths at least 10% of pairs of adjacent cavities have at least one base edge length different between the two cavities of the pair, wherein the production tool is an engraved metal roll, and wherein each of the cavities has a single opening; and

forming the production tool using the design.

173. (AMENDED) A method of making a production tool, the method comprising:

creating a design for a production tool for manufacturing an abrasive article, the production tool comprising a plurality of cavities the cavities each have dimensions defining the cavity, the dimensions including base edge lengths at least 30% of pairs of adjacent cavities have at least one base edge length different between the two cavities of the pair, wherein the production tool is an engraved metal roll, and wherein each of the cavities has a single opening; and

forming the production tool using the design.

174. (AMENDED) A method of making a production tool, the method comprising:

creating a design for a production tool for manufacturing an abrasive article, the production tool comprising a plurality of cavities the cavities each have dimensions defining the cavity, the dimensions including base edge lengths at least 50% of pairs of adjacent cavities have at least one

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base edge length different between the two cavities of the pair, wherein the production tool is an engraved metal roll, and wherein each of the cavities has a single opening; and  
forming the production tool using the design.

175. (AMENDED) A method of making a production tool, the method comprising:  
creating a design for a production tool for manufacturing an abrasive article, the production tool comprising a plurality of cavities the cavities each have dimensions defining the cavity, the dimensions including base edge lengths at least two adjacent cavities have at least one base edge length different between the two cavities, wherein the production tool is an engraved metal roll, and wherein each of the cavities has a single opening; and  
forming the production tool using the design.

**Amendment and Response**

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Serial No.: 09/520,032

Confirmation No.: Unknown

Filed: 6 March 2000

For: TOOLS TO MANUFACTURE ABRASIVE ARTICLES

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**Remarks**

The Office Action mailed 27 September 2001 has been received and reviewed. Claims 17, 20-21, 25-28, 33-54, 94-96, 98-111, and 133-175 having been amended, the pending claims are claims 17, 19-21, 25-28, 33-54, 94-96, 98-111, and 133-175. Reconsideration and withdrawal of the rejections are respectfully requested.

Applicants would like to thank the Examiner for notification to the effect that claim 19 has been allowed.

**The 35 U.S.C. §102 Rejections**

The Examiner rejected claims 25-28 and 94-96 under 35 U.S.C. §102(b) as being anticipated by Rochlis (U.S. Patent No. 3,312,583). The Examiner rejected claims 20, 21, 33, 34, 36-45, 47-54, 98, 99, 101-106, and 108-111 under 35 U.S.C. §102(b) as being anticipated by Rochlis (U.S. Patent No. 3,312,583). These rejections are respectfully traversed.

Each of the independent claims (except allowed claim 19) recites that each of the cavities has a single opening. In contrast, all embodiments of the mold disclosed in '583 (Rochlis) require a laminate construction, which inherently results in multiple openings (i.e., one opening per layer). There is no teaching or suggestion in '583, however, that any cavity, let alone each of the cavities, has a single opening.

**The 35 U.S.C. §103 Rejection**

The Examiner rejected claims 17, 20, 21, 33-54, and 98-111 under 35 U.S.C. §103(a) as unpatentable over Rochlis (U.S. Patent No. 3,312,583). This rejection is respectfully traversed.

Again, each of the independent claims (except allowed claim 19) recites that each of the cavities has a single opening. In contrast, all embodiments of the mold disclosed in '583 (Rochlis) require a laminate construction, which inherently results in multiple openings (i.e., one opening per layer). There is no teaching or suggestion in '583, however, that any cavity, let alone each of the cavities, has a single opening.

**Amendment and Response**

Serial No.: 09/520,032

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**Interview Summary**

The undersigned acknowledges with appreciation the in-person interview granted to Greg Allen and Ann Muetting on October 18, 2001, wherein the essence of this response was discussed.

Further, in response to the Examiner's comments at the interview indicating that if the claims were amended to require a single opening for each of the cavities, it would be necessary to show the criticality of having such single openings, it is submitted it is not clear, absent the inappropriate use of hindsight analysis, why one of ordinary skill in the art reading '583 (Rochlis), would be motivated to modify this disclosure to provide Applicants' claimed invention.

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**Amendment and Response**

Serial No.: 09/520,032

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**Summary**

It is respectfully submitted that the pending claims 17, 19-21, 25-28, 33-54, 94-96, 98-111, and 133-175 are in condition for allowance and notification to that effect is respectfully requested. The Examiner is invited to contact Applicants' Representatives, at the below-listed telephone number, if it is believed that prosecution of this application may be assisted thereby.

Respectfully submitted for  
HOOPMAN et al.

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**CERTIFICATE UNDER 37 CFR §1.8:**

The undersigned hereby certifies that this paper is being transmitted by facsimile in accordance with 37 CFR §1.6(d) to the Patent and Trademark Office, addressed to Assistant Commissioner for Patents, Washington, D.C. 20231, on this 10:15 pm (Central Time).

27th day of December, 2001, at

By:

Ann M. Mueting

Name: Ann M. Mueting

**APPENDIX A - SPECIFICATION/CLAIM AMENDMENTS  
INCLUDING NOTATIONS TO INDICATE CHANGES MADE**

**Serial No.: 09/520,032**

**Docket No.: 49933US031 (formerly 49933USA6H.031)**

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Amendments to the following are indicated by underlining what has been added and bracketing what has been deleted. Additionally, all amendments have been marked in bold typeface.

**In the Claims**

For convenience, all pending claims are shown below.

17. (THRICE AMENDED) A production tool for manufacturing an abrasive article that comprises a major surface having deployed in fixed position thereon first and second three-dimensional abrasive composites, each of said composites comprising abrasive particles dispersed in a binder and having a shape defined by a substantially distinct and discernible boundary which includes substantially specific dimensions said first abrasive composite has a shape having specific first dimensions and said second abrasive composite has a second shape having second specific dimensions each of said abrasive composites has a boundary defined by at least four planar surfaces adjacent planar surfaces of one composite meet at an edge to define an angle of intersection therebetween at least one angle of intersection of said first abrasive composite is different from all of the angles of intersection of said second composite, said production tool comprising a structure having a plurality of adjacent three-dimensional cavities form on a major surface thereof each three-dimensional cavity is defined by a substantially distinct and discernible boundary which includes substantially specific dimensions a first three-dimensional cavity has a first shape having specific first dimensions and a second three-dimensional cavity has a second shape having second specific dimensions each of said three-dimensional cavities has a boundary defined by at least four planar surfaces wherein adjacent planar surfaces of one three-dimensional cavity meet at an edge to define an angle of intersection therebetween at least one angle of intersection of said first three-dimensional cavity is different from all angles of intersection of said second three-dimensional cavity said three-dimensional cavities comprise pyramidal shapes each pyramidal shape comprises planar surfaces which intersect to form a material-included angle at a distal end of said pyramid, **[and]** wherein said

material-included angle is a value from  $25^{\circ}$  to  $90^{\circ}$ , and wherein each of the cavities has a single opening.

19. (ALLOWED) A production tool useful to shape an abrasive slurry into an array of three-dimensional nonidentical abrasive composites, said production tool manufactured by a method comprising:

(A) preparing a master tool, the method comprising:

(1) determining angles corresponding to facing right and left planar surfaces of adjacent three-dimensional shapes and wherein each of said angles has a value as measured between its planar surface and a plane which extends in a normal direction to said major surface and contains an edge of said planar surface in contact with said major surface, by the following substeps:

(i) selecting an angle value between, but not including,  $0^{\circ}$  and  $90^{\circ}$  to establish a first right half angle of a first right planar surface of a first right-side three-dimensional shape with a random number generating means capable of randomly selecting an angle value between, but not including,  $0^{\circ}$  and  $90^{\circ}$ ;

(ii) selecting an angle value between, but not including,  $0^{\circ}$  and  $90^{\circ}$  with said random number generating means to establish a first left half angle for a first left planar surface of a first left-side three-dimensional shape facing said first right planar surface of said first right-side three-dimensional shape;

(iii) proceeding along a first direction extending linearly within said first imaginary plane to a second left planar surface of a second left-side three-dimensional shape located adjacent said first left-side three-dimensional shape and using said random number generating means to select a value between, but not including,  $0^{\circ}$  and  $90^{\circ}$  to establish a second left planar angle for said second left planar surface;

(iv) using said random number generating means to select a value between, but not including,  $0^{\circ}$  and  $90^{\circ}$  for a second right planar surface of a second right-side three-

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dimensional shape facing said second left planar surface;

(v) proceeding along said first direction to a third right-side three-dimensional shape located adjacent said second right-side three-dimensional shape;

(vi) repeating said substeps (i), (ii), (iii), (iv), and (v), in that sequence, at least once;

(2) repeating step (1) except that the angles are determined for left and right planar surfaces of adjacent three-dimensional shapes deployed in two adjacent rows in a second direction extending linearly within said first imaginary plane said first and second directions intersect;

(3) using means to determine, for a given width of said surface of said master tool, locations of grooves required to be cut by a cutting means to form a series of intersecting grooves defining a plurality of three-dimensional shapes having said angles calculated by steps (1) and (2); and

(4) providing a cutting means to cut grooves in said surface of said master tool in correspondence to said angles calculated by steps (1) and (2) and said groove locations determined by step (3) to form a series of intersecting grooves which define a plurality of three-dimensional shapes upraised from said surface, each of said shapes being defined by a distinct and discernible boundary including specific dimensions not all said three-dimensional shapes are identical; and

(B) forming the production tool using the master tool.

20. (THRICE AMENDED) A production tool for manufacturing an abrasive article that comprises a major surface having deployed in fixed position thereon first and second three-dimensional abrasive composites, each of said composites comprising abrasive particles dispersed in a binder and having a shape defined by a substantially distinct and discernible boundary which includes substantially specific dimensions said first abrasive composite has a shape having specific first dimensions and said second abrasive composite has a second shape having second specific dimensions each of said abrasive composites has a boundary defined by at

least four planar surfaces wherein adjacent planar surfaces of one composite meet at an edge to define an angle of intersection therebetween at least one angle of intersection of said first abrasive composite is different from all of the angles of intersection of said second composite, said production tool comprising a structure having a plurality of adjacent three-dimensional cavities form on a major surface thereof each three-dimensional cavity is defined by a substantially distinct and discernible boundary which includes substantially specific dimensions a first three-dimensional cavity has a first shape having specific first dimensions and a second three-dimensional cavity has a second shape having second specific dimensions each of said three-dimensional cavities has a boundary defined by at least four planar surfaces wherein adjacent planar surfaces of one three-dimensional cavity meet at an edge to define an angle of intersection therebetween at least one angle of intersection of said first three-dimensional cavity is different from all angles of intersection of said second three-dimensional cavity, **[and]** wherein the production tool is a roll, **and wherein each of the cavities has a single opening.**

21. (THRICE AMENDED) A production tool for manufacturing an abrasive article that comprises a major surface having deployed in fixed position thereon first and second three-dimensional abrasive composites, each of said composites comprising abrasive particles dispersed in a binder and having a shape defined by a substantially distinct and discernible boundary which includes substantially specific dimensions said first abrasive composite has a shape having specific first dimensions and said second abrasive composite has a second shape having second specific dimensions each of said abrasive composites has a boundary defined by at least four planar surfaces wherein adjacent planar surfaces of one composite meet at an edge to define an angle of intersection therebetween at least one angle of intersection of said first abrasive composite is different from all of the angles of intersection of said second composite, said production tool comprising a structure having a plurality of adjacent three-dimensional cavities form on a major surface thereof each three-dimensional cavity is defined by a substantially distinct and discernible boundary which includes substantially specific dimensions a

first three-dimensional cavity has a first shape having specific first dimensions and a second three-dimensional cavity has a second shape having second specific dimensions each of said three-dimensional cavities has a boundary defined by at least four planar surfaces wherein adjacent planar surfaces of one three-dimensional cavity meet at an edge to define an angle of intersection therebetween at least one angle of intersection of said first three-dimensional cavity is different from all angles of intersection of said second three-dimensional cavity, **[and]** wherein the production tool is a coating roll, **and wherein each of the cavities has a single opening.**

25. (TWICE AMENDED) A production tool suitable for use in manufacturing an abrasive article comprising a plurality of cavities the cavities each have dimensions defining the cavity, **[and]** wherein at least 10% of pairs of adjacent cavities have at least one dimension different between the two cavities of the pair, **and wherein each of the cavities has a single opening.**

26. (TWICE AMENDED) A production tool suitable for use in manufacturing an abrasive article comprising a plurality of cavities the cavities each have dimensions defining the cavity, **[and]** wherein at least 30% of pairs of adjacent cavities have at least one dimension different between the two cavities of the pair, **and wherein each of the cavities has a single opening.**

27. (TWICE AMENDED) A production tool suitable for use in manufacturing an abrasive article comprising a plurality of cavities the cavities each have dimensions defining the cavity, **[and]** wherein at least 50% of pairs of adjacent cavities have at least one dimension different between the two cavities of the pair, **and wherein each of the cavities has a single opening.**

28. (AMENDED) A production tool suitable for use in manufacturing an abrasive article comprising a plurality of cavities the cavities each have a geometric shape, dimensions defining the cavity, and angles forming the geometric shape the angles are different in at least two of the cavities,

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[and further] wherein at least 10% of pairs of adjacent cavities have at least one dimension different between the two cavities of the pair, **and wherein each of the cavities has a single opening.**

33. (THRICE AMENDED) A production tool suitable for use in manufacturing an abrasive article comprising a first and second plurality of cavities the first plurality of cavities each have a first geometric shape and first plurality of angles forming the geometric shape and the second plurality of cavities each have a second geometric shape and second plurality of angles forming the geometric shape at least one of the angles of the first plurality is different from all of the angles of the second plurality of angles, [and] wherein the production tool is a coating roll, **and wherein each of the cavities has a single opening.**

34. (THRICE AMENDED) A production tool suitable for use in manufacturing an abrasive article comprising a first, second, and third plurality of cavities the first plurality of cavities each have a first geometric shape and first plurality of angles forming the geometric shape, the second plurality of cavities each have a second geometric shape and second plurality of angles forming the geometric shape, and the third plurality of cavities each have a third geometric shape and third plurality of angles forming the geometric shape at least one of the angles of the first plurality is different from all of the angles of the second and third plurality of angles at least one of the angles of the second plurality is different from all of the angles of the first and third plurality of angles, [and] wherein the production tool is a coating roll, **and wherein each of the cavities has a single opening.**

35. (THRICE AMENDED) A production tool suitable for use in manufacturing an abrasive article comprising a first, second, third, and fourth plurality of cavities the first plurality of cavities each have a first geometric shape and first plurality of angles forming the geometric shape, the second plurality of cavities each have a second geometric shape and second plurality of angles forming the geometric shape, the third plurality of cavities each have a third geometric shape and third plurality of angles forming the geometric shape, and the fourth plurality of cavities each have a

fourth geometric shape and fourth plurality of angles forming the geometric shape at least one of the angles of the first plurality is different from all of the angles of the second, third, and fourth plurality of angles at least one of the angles of the second plurality is different from all of the angles of the first, third, and fourth plurality of angles at least one of the angles of the third plurality is different from all of the angles of the first, second, and fourth plurality of angles, **[and]** wherein the production tool is a coating roll, **and wherein each of the cavities has a single opening.**

36. (THRICE AMENDED) A production tool suitable for use in manufacturing an abrasive article comprising a plurality of cavities the cavities each have dimensions defining the cavity at least 10% of pairs of adjacent cavities have at least one dimension different between the two cavities of the pair, **[and]** wherein the production tool is a coating roll, **and wherein each of the cavities has a single opening.**

37. (THRICE AMENDED) A production tool suitable for use in manufacturing an abrasive article comprising a plurality of cavities the cavities each have dimensions defining the cavity at least 30% of pairs of adjacent cavities have at least one dimension different between the two cavities of the pair, **[and]** wherein the production tool is a coating roll, **and wherein each of the cavities has a single opening.**

38. (THRICE AMENDED) A production tool suitable for use in manufacturing an abrasive article comprising a plurality of cavities the cavities each have dimensions defining the cavity at least 50% of pairs of adjacent cavities have at least one dimension different between the two cavities of the pair, **[and]** wherein the production tool is a coating roll, **and wherein each of the cavities has a single opening.**

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39. (THRICE AMENDED) A production tool suitable for use in manufacturing an abrasive article comprising a plurality of cavities the cavities each have a geometric shape, dimensions

defining the cavity, and angles forming the geometric shape the angles are different in at least two of the cavities at least 10% of pairs of adjacent cavities have at least one dimension different between the two cavities of the pair, **[and]** wherein the production tool is a coating roll, **and wherein each of the cavities has a single opening.**

40. (THRICE AMENDED) A production tool suitable for use in manufacturing an abrasive article comprising a plurality of cavities the cavities each have dimensions defining the cavity at least two adjacent cavities have at least one dimension different between the two cavities, **[and]** wherein the production tool is a coating, **and wherein each of the cavities has a single opening.**

41. (THRICE AMENDED) A production tool suitable for use in manufacturing an abrasive article comprising a plurality of cavities defining at least a first and a second group a first group of cavities has a first shape and a second group of cavities has a second, different, shape, **[and]** wherein the production tool is a coating roll, **and wherein each of the cavities has a single opening.**

42. (THRICE AMENDED) A production tool suitable for use in manufacturing an abrasive article comprising a plurality of cavities defining at least a first and a second group a first group of cavities has a first size and a second group of cavities has a second, different, size, **[and]** wherein the production tool is a coating roll, **and wherein each of the cavities has a single opening.**

43. (THRICE AMENDED) A production tool suitable for use in manufacturing an abrasive article comprising a plurality of cavities defined by substantially distinct and discernible boundaries which include substantially specific dimensions a first cavity has specific first dimensions and a second cavity has specific second dimensions, each of said cavities has a boundary defined by at least four planar surfaces wherein adjacent planar surfaces of one cavity meet at an edge to define an angle of intersection therebetween at least one angle of intersection of said first cavity is different from all

the angles of intersection of said second cavity, **[and]** wherein the production tool is a coating roll, **and wherein each of the cavities has a single opening.**

44. (THRICE AMENDED) A production tool suitable for use in manufacturing an abrasive article comprising a first and second plurality of cavities the first plurality of cavities each have a first geometric shape and first plurality of angles forming the geometric shape and the second plurality of cavities each have a second geometric shape and second plurality of angles forming the geometric shape at least one of the angles of the first plurality is different from all of the angles of the second plurality of angles, **[and]** wherein the production tool is an engraved metal roll, **and wherein each of the cavities has a single opening.**

45. (THRICE AMENDED) A production tool suitable for use in manufacturing an abrasive article comprising a first, second, and third plurality of cavities the first plurality of cavities each have a first geometric shape and first plurality of angles forming the geometric shape, the second plurality of cavities each have a second geometric shape and second plurality of angles forming the geometric shape, and the third plurality of cavities each have a third geometric shape and third plurality of angles forming the geometric shape at least one of the angles of the first plurality is different from all of the angles of the second and third plurality of angles at least one of the angles of the second plurality is different from all of the angles of the first and third plurality of angles, **[and]** wherein the production tool is an engraved metal roll, **and wherein each of the cavities has a single opening.**

46. (THRICE AMENDED) A production tool suitable for use in manufacturing an abrasive article comprising a first, second, third, and fourth plurality of cavities the first plurality of cavities each have a first geometric shape and first plurality of angles forming the geometric shape, the second plurality of cavities each have a second geometric shape and second plurality of angles forming the geometric shape, the third plurality of cavities each have a third geometric shape and third plurality of angles forming the geometric shape, and the fourth plurality of cavities each have a

fourth geometric shape and fourth plurality of angles forming the geometric shape at least one of the angles of the first plurality is different from all of the angles of the second, third, and fourth plurality of angles at least one of the angles of the second plurality is different from all of the angles of the first, third, and fourth plurality of angles at least one of the angles of the third plurality is different from all of the angles of the first, second, and fourth plurality of angles, **[and]** wherein the production tool is an engraved metal roll, **and wherein each of the cavities has a single opening.**

47. (THRICE AMENDED) A production tool suitable for use in manufacturing an abrasive article comprising a plurality of cavities the cavities each have dimensions defining the cavity at least 10% of pairs of adjacent cavities have at least one dimension different between the two cavities of the pair, **[and]** wherein the production tool is an engraved metal roll, **and wherein each of the cavities has a single opening.**

48. (THRICE AMENDED) A production tool suitable for use in manufacturing an abrasive article comprising a plurality of cavities the cavities each have dimensions defining the cavity at least 30% of pairs of adjacent cavities have at least one dimension different between the two cavities of the pair, **[and]** wherein the production tool is an engraved metal roll, **and wherein each of the cavities has a single opening.**

49. (THRICE AMENDED) A production tool suitable for use in manufacturing an abrasive article comprising a plurality of cavities the cavities each have dimensions defining the cavity at least 50% of pairs of adjacent cavities have at least one dimension different between the two cavities of the pair, **[and]** wherein the production tool is an engraved metal roll, **and wherein each of the cavities has a single opening.**

50. (THRICE AMENDED) A production tool suitable for use in manufacturing an abrasive article comprising a plurality of cavities the cavities each have a geometric shape, dimensions

defining the cavity, and angles forming the geometric shape the angles are different in at least two of the cavities at least 10% of pairs of adjacent cavities have at least one dimension different between the two cavities of the pair, **[and]** wherein the production tool is an engraved metal roll, **and wherein each of the cavities has a single opening.**

51. (THRICE AMENDED) A production tool suitable for use in manufacturing an abrasive article comprising a plurality of cavities the cavities each have dimensions defining the cavity at least two adjacent cavities have at least one dimension different between the two cavities, **[and]** wherein the production tool is an engraved metal roll, **and wherein each of the cavities has a single opening.**

52. (THRICE AMENDED) A production tool suitable for use in manufacturing an abrasive article comprising a plurality of cavities defining at least a first and a second group a first group of cavities has a first shape and a second group of cavities has a second, different, shape, **[and]** wherein the production tool is an engraved metal roll, **and wherein each of the cavities has a single opening.**

53. (THRICE AMENDED) A production tool suitable for use in manufacturing an abrasive article comprising a plurality of cavities defining at least a first and a second group a first group of cavities has a first size and a second group of cavities has a second, different, size, **[and]** wherein the production tool is an engraved metal roll, **and wherein each of the cavities has a single opening.**

54. (THRICE AMENDED) A production tool suitable for use in manufacturing an abrasive article comprising a plurality of cavities defined by substantially distinct and discernible boundaries which include substantially specific dimensions a first cavity has specific first dimensions and a second cavity has specific second dimensions, each of said cavities has a boundary defined by at least four planar surfaces adjacent planar surfaces of one cavity meet at an edge to define an angle of intersection-therebetween-at-least-one-angle-of-intersection-of-said-first-cavity-is-different-from-all the

angles of intersection of said second cavity, **[and]** wherein the production tool is an engraved metal roll, **and wherein each of the cavities has a single opening.**

94. (TWICE AMENDED) A production tool suitable for use in manufacturing an abrasive article comprising a plurality of cavities the cavities each have dimensions defining the cavity, the dimensions including base edge lengths, **[and]** wherein at least 10% of pairs of adjacent cavities have at least one base edge length different between the two cavities of the pair, **and wherein each of the cavities has a single opening.**

95. (TWICE AMENDED) A production tool suitable for use in manufacturing an abrasive article comprising a plurality of cavities the cavities each have dimensions defining the cavity, the dimensions including base edge lengths, **[and]** wherein at least 30% of pairs of adjacent cavities have at least one base edge length different between the two cavities of the pair, **and wherein each of the cavities has a single opening.**

96. (TWICE AMENDED) A production tool suitable for use in manufacturing an abrasive article comprising a plurality of cavities the cavities each have dimensions defining the cavity, the dimensions including base edge lengths, **[and]** wherein at least 50% of pairs of adjacent cavities have at least one base edge length different between the two cavities of the pair, **and wherein each of the cavities has a single opening.**

98. (THRICE AMENDED) A production tool suitable for use in manufacturing an abrasive article comprising a first and second plurality of cavities the first plurality of cavities each have a first geometric shape including a base and first plurality of base edge lengths forming the base of the geometric shape and the second plurality of cavities each have a second geometric shape including a base and second plurality of base edge lengths forming the base of the geometric shape at least one of the base edge lengths of the first plurality is different from all of the base edge lengths of the

second plurality of base edge lengths, **[and]** wherein the production tool is a coating roll, **and wherein each of the cavities has a single opening.**

99. (THRICE AMENDED) A production tool suitable for use in manufacturing an abrasive article comprising a first, second, and third plurality of cavities the first plurality of cavities each have a first geometric shape including a base and first plurality of base edge lengths forming the base of the geometric shape, the second plurality of cavities each have a second geometric shape including a base and second plurality of base edge lengths forming the base of the geometric shape, and the third plurality of cavities each have a third geometric shape including a base and third plurality of base edge lengths forming the base of the geometric shape at least one of the base edge lengths of the first plurality is different from all of the base edge lengths of the second and third plurality of base edge lengths at least one of the base edge lengths of the second plurality is different from all of the base edge lengths of the first and third plurality of base edge lengths, **[and]** wherein the production tool is a coating roll, **and wherein each of the cavities has a single opening.**

100. (THRICE AMENDED) A production tool suitable for use in manufacturing an abrasive article comprising a first, second, third, and fourth plurality of cavities the first plurality of cavities each have a first geometric shape including a base and first plurality of base edge lengths forming the base of the geometric shape, the second plurality of cavities each have a second geometric shape including a base and second plurality of base edge lengths forming the base of the geometric shape, the third plurality of cavities each have a third geometric shape including a base and third plurality of base edge lengths forming the base of the geometric shape, and the fourth plurality of cavities each have a fourth geometric shape including a base and fourth plurality of base edge lengths forming the base of the geometric shape at least one of the base edge lengths of the first plurality is different from all of the base edge lengths of the second, third, and fourth plurality of base edge lengths at least one of the base edge lengths of the second plurality is different from all of the base edge lengths of the first, third, and fourth plurality of base edge lengths at least one of the base edge lengths of the third

plurality is different from all of the base edge lengths of the first, second, and fourth plurality of base edge lengths, **[and]** wherein the production tool is a coating roll, **and wherein each of the cavities has a single opening.**

101. (THRICE AMENDED) A production tool suitable for use in manufacturing an abrasive article comprising a plurality of cavities the cavities each have dimensions defining the cavity, the dimensions including base edge lengths at least 10% of pairs of adjacent cavities have at least one base edge length different between the two cavities of the pair, **[and]** wherein the production tool is a coating roll, **and wherein each of the cavities has a single opening.**

102. (THRICE AMENDED) A production tool suitable for use in manufacturing an abrasive article comprising a plurality of cavities the cavities each have dimensions defining the cavity, the dimensions including base edge lengths at least 30% of pairs of adjacent cavities have at least one base edge length different between the two cavities of the pair, **[and]** wherein the production tool is a coating roll, **and wherein each of the cavities has a single opening.**

103. (THRICE AMENDED) A production tool suitable for use in manufacturing an abrasive article comprising a plurality of cavities the cavities each have dimensions defining the cavity, the dimensions including base edge lengths at least 50% of pairs of adjacent cavities have at least one base edge length different between the two cavities of the pair, **[and]** wherein the production tool is a coating roll, **and wherein each of the cavities has a single opening.**

104. (THRICE AMENDED) A production tool suitable for use in manufacturing an abrasive article comprising a plurality of cavities the cavities each have dimensions defining the cavity, the dimensions including base edge lengths at least two adjacent cavities have at least one base edge length different between the two cavities, **[and]** wherein the production tool is a coating roll, **and wherein each of the cavities has a single opening.**

105. (THRICE AMENDED) A production tool suitable for use in manufacturing an abrasive article comprising a first and second plurality of cavities the first plurality of cavities each have a first geometric shape including a base and first plurality of base edge lengths forming the base of the geometric shape and the second plurality of cavities each have a second geometric shape including a base and second plurality of base edge lengths forming the base of the geometric shape at least one of the base edge lengths of the first plurality is different from all of the base edge lengths of the second plurality of base edge lengths, **[and]** wherein the production tool is an engraved metal roll, **and wherein each of the cavities has a single opening.**

106. (THRICE AMENDED) A production tool suitable for use in manufacturing an abrasive article comprising a first, second, and third plurality of cavities the first plurality of cavities each have a first geometric shape including a base and first plurality of base edge lengths forming the base of the geometric shape, the second plurality of cavities each have a second geometric shape including a base and second plurality of base edge lengths forming the base of the geometric shape, and the third plurality of cavities each have a third geometric shape including a base and third plurality of base edge lengths forming the base of the geometric shape at least one of the base edge lengths of the first plurality is different from all of the base edge lengths of the second and third plurality of base edge lengths at least one of the base edge lengths of the second plurality is different from all of the base edge lengths of the first and third plurality of base edge lengths, **[and]** wherein the production tool is an engraved metal roll, **and wherein each of the cavities has a single opening.**

107. (THRICE AMENDED) A production tool suitable for use in manufacturing an abrasive article comprising a first, second, third, and fourth plurality of cavities the first plurality of cavities each have a first geometric shape including a base and first plurality of base edge lengths forming the base of the geometric shape; the second plurality of cavities each have a second geometric shape including a base and second plurality of base edge lengths forming the base of the geometric shape,

the third plurality of cavities each have a third geometric shape including a base and third plurality of base edge lengths forming the base of the geometric shape, and the fourth plurality of cavities each have a fourth geometric shape including a base and fourth plurality of base edge lengths forming the base of the geometric shape at least one of the base edge lengths of the first plurality is different from all of the base edge lengths of the second, third, and fourth plurality of base edge lengths at least one of the base edge lengths of the second plurality is different from all of the base edge lengths of the first, third, and fourth plurality of base edge lengths at least one of the base edge lengths of the third plurality is different from all of the base edge lengths of the first, second, and fourth plurality of base edge lengths, **[and]** wherein the production tool is an engraved metal roll, **and wherein each of the cavities has a single opening.**

108. (THRICE AMENDED) A production tool suitable for use in manufacturing an abrasive article comprising a plurality of cavities the cavities each have dimensions defining the cavity, the dimensions including base edge lengths at least 10% of pairs of adjacent cavities have at least one base edge length different between the two cavities of the pair, **[and]** wherein the production tool is an engraved metal roll, **and wherein each of the cavities has a single opening.**

109. (THRICE AMENDED) A production tool suitable for use in manufacturing an abrasive article comprising a plurality of cavities the cavities each have dimensions defining the cavity, the dimensions including base edge lengths at least 30% of pairs of adjacent cavities have at least one base edge length different between the two cavities of the pair, **[and]** wherein the production tool is an engraved metal roll, **and wherein each of the cavities has a single opening.**

110. (THRICE AMENDED) A production tool suitable for use in manufacturing an abrasive article comprising a plurality of cavities the cavities each have dimensions defining the cavity, the dimensions including base edge lengths at least 50% of pairs of adjacent cavities have at least one

base edge length different between the two cavities of the pair, **[and]** wherein the production tool is an engraved metal roll, **and wherein each of the cavities has a single opening.**

111. (THRICE AMENDED) A production tool suitable for use in manufacturing an abrasive article comprising a plurality of cavities the cavities each have dimensions defining the cavity, the dimensions including base edge lengths at least two adjacent cavities have at least one base edge length different between the two cavities, **[and]** wherein the production tool is an engraved metal roll, **and wherein each of the cavities has a single opening.**

133. (AMENDED) A method of making a production tool, the method comprising:  
creating a design for a production tool for manufacturing an abrasive article, the production tool comprising a plurality of cavities the cavities each have dimensions defining the cavity, **[and]** wherein at least 10% of pairs of adjacent cavities have at least one dimension different between the two cavities of the pair, **and wherein each of the cavities has a single opening;** and  
forming the production tool using the design.

134. (AMENDED) A method of making a production tool, the method comprising:  
creating a design for a production tool for manufacturing an abrasive article, the production tool comprising a plurality of cavities the cavities each have dimensions defining the cavity, **[and]** wherein at least 30% of pairs of adjacent cavities have at least one dimension different between the two cavities of the pair, **and wherein each of the cavities has a single opening;** and  
forming the production tool using the design.

135. (AMENDED) A method of making a production tool, the method comprising:  
creating a design for a production tool for manufacturing an abrasive article, the production tool comprising a plurality of cavities the cavities each have dimensions defining the cavity, **[and]**

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wherein at least 50% of pairs of adjacent cavities have at least one dimension different between the two cavities of the pair, **and wherein each of the cavities has a single opening**; and forming the production tool using the design.

136. (AMENDED) A method of making a production tool, the method comprising:  
creating a design for a production tool for manufacturing an abrasive article, the production tool comprising a plurality of cavities the cavities each have a geometric shape, dimensions defining the cavity, and angles forming the geometric shape the angles are different in at least two of the cavities, **[and further]** wherein at least 10% of pairs of adjacent cavities have at least one dimension different between the two cavities of the pair, **and wherein each of the cavities has a single opening**; and forming the production tool using the design.

137. (AMENDED) A method of making a production tool, the method comprising:  
creating a design for a production tool for manufacturing an abrasive article, the production tool comprising a first and second plurality of cavities the first plurality of cavities each have a first geometric shape and first plurality of angles forming the geometric shape and the second plurality of cavities each have a second geometric shape and second plurality of angles forming the geometric shape at least one of the angles of the first plurality is different from all of the angles of the second plurality of angles, **[and]** wherein the production tool is a coating roll, **and wherein each of the cavities has a single opening**; and forming the production tool using the design.

138. (AMENDED) A method of making a production tool, the method comprising:  
creating a design for a production tool for manufacturing an abrasive article, the production tool comprising a first, second, and third plurality of cavities the first plurality of cavities each have a first geometric shape and first plurality of angles forming the geometric shape, the second plurality of

cavities each have a second geometric shape and second plurality of angles forming the geometric shape, and the third plurality of cavities each have a third geometric shape and third plurality of angles forming the geometric shape at least one of the angles of the first plurality is different from all of the angles of the second and third plurality of angles at least one of the angles of the second plurality is different from all of the angles of the first and third plurality of angles, **[and]** wherein the production tool is a coating roll, **and wherein each of the cavities has a single opening**; and forming the production tool using the design.

139. (AMENDED) A method of making a production tool, the method comprising:

creating a design for a production tool for manufacturing an abrasive article, the production tool comprising a first, second, third, and fourth plurality of cavities the first plurality of cavities each have a first geometric shape and first plurality of angles forming the geometric shape, the second plurality of cavities each have a second geometric shape and second plurality of angles forming the geometric shape, the third plurality of cavities each have a third geometric shape and third plurality of angles forming the geometric shape, and the fourth plurality of cavities each have a fourth geometric shape and fourth plurality of angles forming the geometric shape at least one of the angles of the first plurality is different from all of the angles of the second, third, and fourth plurality of angles at least one of the angles of the second plurality is different from all of the angles of the first, third, and fourth plurality of angles at least one of the angles of the third plurality is different from all of the angles of the first, second, and fourth plurality of angles, **[and]** wherein the production tool is a coating roll, **and wherein each of the cavities has a single opening**; and forming the production tool using the design.

140. (AMENDED) A method of making a production tool, the method comprising:

creating a design for a production tool for manufacturing an abrasive article, the production tool comprising a plurality of cavities the cavities each have dimensions defining the cavity at least 10% of pairs of adjacent cavities have at least one dimension different between the two cavities of the

pair, [and] wherein the production tool is a coating roll, and wherein each of the cavities has a single opening; and

forming the production tool using the design.

141. (AMENDED) A method of making a production tool, the method comprising:

creating a design for a production tool for manufacturing an abrasive article, the production tool comprising a plurality of cavities the cavities each have dimensions defining the cavity at least 30% of pairs of adjacent cavities have at least one dimension different between the two cavities of the pair, [and] wherein the production tool is a coating roll, and wherein each of the cavities has a single opening; and

forming the production tool using the design.

142. (AMENDED) A method of making a production tool, the method comprising:

creating a design for a production tool for manufacturing an abrasive article, the production tool comprising a plurality of cavities the cavities each have dimensions defining the cavity at least 50% of pairs of adjacent cavities have at least one dimension different between the two cavities of the pair, [and] wherein the production tool is a coating roll, and wherein each of the cavities has a single opening; and

forming the production tool using the design.

143. (AMENDED) A method of making a production tool, the method comprising:

creating a design for a production tool for manufacturing an abrasive article, the production tool comprising a plurality of cavities the cavities each have a geometric shape, dimensions defining the cavity, and angles forming the geometric shape the angles are different in at least two of the cavities at least 10% of pairs of adjacent cavities have at least one dimension different between the two cavities of the pair, [and] wherein the production tool is a coating roll, and wherein each of the cavities has a single opening; and

forming the production tool using the design.

144. (AMENDED) A method of making a production tool, the method comprising:

creating a design for a production tool for manufacturing an abrasive article, the production tool comprising a plurality of cavities the cavities each have dimensions defining the cavity at least two adjacent cavities have at least one dimension different between the two cavities, **[and]** wherein the production tool is a coating roll, **and wherein each of the cavities has a single opening**; and forming the production tool using the design.

145. (AMENDED) A method of making a production tool, the method comprising:

creating a design for a production tool for manufacturing an abrasive article, the production tool comprising a plurality of cavities defining at least a first and a second group a first group of cavities has a first shape and a second group of cavities has a second, different, shape, **[and]** wherein the production tool is a coating roll; **and wherein each of the cavities has a single opening**, and forming the production tool using the design.

146. (AMENDED) A method of making a production tool, the method comprising:

creating a design for a production tool for manufacturing an abrasive article, the production tool comprising a plurality of cavities defining at least a first and a second group a first group of cavities has a first size and a second group of cavities has a second, different, size, **[and]** wherein the production tool is a coating roll, **and wherein each of the cavities has a single opening**; and forming the production tool using the design.

147. (AMENDED) A method of making a production tool, the method comprising:

creating a design for a production tool for manufacturing an abrasive article, the production tool comprising a plurality of cavities defined by substantially distinct and discernible boundaries which include substantially specific dimensions a first cavity has specific first dimensions and a

second cavity has specific second dimensions, each of said cavities has a boundary defined by at least four planar surfaces adjacent planar surfaces of one cavity meet at an edge to define an angle of intersection therebetween at least one angle of intersection of said first cavity is different from all the angles of intersection of said second cavity, **[and]** wherein the production tool is a coating roll, **and wherein each of the cavities has a single opening;** and  
forming the production tool using the design.

148. (AMENDED) A method of making a production tool, the method comprising:

creating a design for a production tool for manufacturing an abrasive article, the production tool comprising a first and second plurality of cavities the first plurality of cavities each have a first geometric shape and first plurality of angles forming the geometric shape and the second plurality of cavities each have a second geometric shape and second plurality of angles forming the geometric shape at least one of the angles of the first plurality is different from all of the angles of the second plurality of angles, **[and]** wherein the production tool is an engraved metal roll, **and wherein each of the cavities has a single opening;** and  
forming the production tool using the design.

149. (AMENDED) A method of making a production tool, the method comprising:

creating a design for a production tool for manufacturing an abrasive article, the production tool comprising a first, second, and third plurality of cavities the first plurality of cavities each have a first geometric shape and first plurality of angles forming the geometric shape, the second plurality of cavities each have a second geometric shape and second plurality of angles forming the geometric shape, and the third plurality of cavities each have a third geometric shape and third plurality of angles forming the geometric shape at least one of the angles of the first plurality is different from all of the angles of the second and third plurality of angles at least one of the angles of the second plurality is different from all of the angles of the first and third plurality of angles, **[and]** wherein the production tool is an engraved metal roll, **and wherein each of the cavities has a single opening;**

and

forming the production tool using the design.

150. (AMENDED) A method of making a production tool, the method comprising:

creating a design for a production tool for manufacturing an abrasive article, the production tool comprising a first, second, third, and fourth plurality of cavities the first plurality of cavities each have a first geometric shape and first plurality of angles forming the geometric shape, the second plurality of cavities each have a second geometric shape and second plurality of angles forming the geometric shape, the third plurality of cavities each have a third geometric shape and third plurality of angles forming the geometric shape, and the fourth plurality of cavities each have a fourth geometric shape and fourth plurality of angles forming the geometric shape at least one of the angles of the first plurality is different from all of the angles of the second, third, and fourth plurality of angles at least one of the angles of the second plurality is different from all of the angles of the first, third, and fourth plurality of angles at least one of the angles of the third plurality is different from all of the angles of the first, second, and fourth plurality of angles, **[and]** wherein the production tool is an engraved metal roll, **and wherein each of the cavities has a single opening;** and

forming the production tool using the design.

151. (AMENDED) A method of making a production tool, the method comprising:

creating a design for a production tool for manufacturing an abrasive article, the production tool comprising a plurality of cavities the cavities each have dimensions defining the cavity at least 10% of pairs of adjacent cavities have at least one dimension different between the two cavities of the pair, **[and]** wherein the production tool is an engraved metal roll, **and wherein each of the cavities has a single opening;** and

forming the production tool using the design.

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152. (AMENDED) A method of making a production tool, the method comprising:  
creating a design for a production tool for manufacturing an abrasive article, the production tool comprising a plurality of cavities the cavities each have dimensions defining the cavity at least 30% of pairs of adjacent cavities have at least one dimension different between the two cavities of the pair, **[and]** wherein the production tool is an engraved metal roll, **and wherein each of the cavities has a single opening**; and

forming the production tool using the design.

153. (AMENDED) A method of making a production tool, the method comprising:  
creating a design for a production tool for manufacturing an abrasive article, the production tool comprising a plurality of cavities the cavities each have dimensions defining the cavity at least 50% of pairs of adjacent cavities have at least one dimension different between the two cavities of the pair, **[and]** wherein the production tool is an engraved metal roll, **and wherein each of the cavities has a single opening**; and

forming the production tool using the design.

154. (AMENDED) A method of making a production tool, the method comprising:  
creating a design for a production tool for manufacturing an abrasive article, the production tool comprising a plurality of cavities the cavities each have a geometric shape, dimensions defining the cavity, and angles forming the geometric shape the angles are different in at least two of the cavities at least 10% of pairs of adjacent cavities have at least one dimension different between the two cavities of the pair, **[and]** wherein the production tool is an engraved metal roll, **and wherein each of the cavities has a single opening**; and

forming the production tool using the design.

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155. (AMENDED) A method of making a production tool, the method comprising:  
creating a design for a production tool for manufacturing an abrasive article, the production

tool comprising a plurality of cavities the cavities each have dimensions defining the cavity at least two adjacent cavities have at least one dimension different between the two cavities, **[and]** wherein the production tool is an engraved metal roll, **and wherein each of the cavities has a single opening;** and

forming the production tool using the design.

156. (AMENDED) A method of making a production tool, the method comprising:

creating a design for a production tool for manufacturing an abrasive article, the production tool comprising a plurality of cavities defining at least a first and a second group a first group of cavities has a first shape and a second group of cavities has a second, different, shape, **[and]** wherein the production tool is an engraved metal roll, **and wherein each of the cavities has a single opening;** and

forming the production tool using the design.

157. (AMENDED) A method of making a production tool, the method comprising:

creating a design for a production tool for manufacturing an abrasive article, the production tool comprising a plurality of cavities defining at least a first and a second group a first group of cavities has a first size and a second group of cavities has a second, different, size, **[and]** wherein the production tool is an engraved metal roll, **and wherein each of the cavities has a single opening;** and

forming the production tool using the design.

158. (AMENDED) A method of making a production tool, the method comprising:

creating a design for a production tool for manufacturing an abrasive article, the production tool comprising a plurality of cavities defined by substantially distinct and discernible boundaries which include substantially specific dimensions a first cavity has specific first dimensions and a second cavity has specific second dimensions, each of said cavities has a boundary defined by at least

four planar surfaces wherein adjacent planar surfaces of one cavity meet at an edge to define an angle of intersection therebetween at least one angle of intersection of said first cavity is different from all the angles of intersection of said second cavity, **[and]** wherein the production tool is an engraved metal roll, **and wherein each of the cavities has a single opening**, and forming the production tool using the design.

159. (AMENDED) A methods of making a production tool, the method comprising:  
creating a design for a production tool for manufacturing an abrasive article, the production tool comprising a plurality of cavities the cavities each have dimensions defining the cavity, the dimensions including base edge lengths, **[and]** wherein at least 10% of pairs of adjacent cavities have at least one base edge length different between the two cavities of the pair, **and wherein each of the cavities has a single opening**; and forming the production tool using the design.

160. (AMENDED) A method of making a production tool, the method comprising:  
creating a design for a production tool for manufacturing an abrasive article, the production tool comprising a plurality of cavities a plurality of cavities the cavities each have dimensions defining the cavity, the dimensions including base edge lengths, **[and]** wherein at least 30% of pairs of adjacent cavities have at least one base edge length different between the two cavities of the pair, **and wherein each of the cavities has a single opening**; and forming the production tool using the design.

161. (AMENDED) A method of making a production tool, the method comprising:  
creating a design for a production tool for manufacturing an abrasive article, the production tool comprising a plurality of cavities the cavities each have dimensions defining the cavity, the dimensions including base edge lengths, **[and]** wherein at least 50% of pairs of adjacent cavities have

at least one base edge length different between the two cavities of the pair, **and wherein each of the cavities has a single opening**; and

forming the production tool using the design.

162. (AMENDED) A method of making a production tool, the method comprising:

creating a design for a production tool for manufacturing an abrasive article, the production tool comprising a first and second plurality of cavities the first plurality of cavities each have a first geometric shape including a base and first plurality of base edge lengths forming the base of the geometric shape and the second plurality of cavities each have a second geometric shape including a base and second plurality of base edge lengths forming the base of the geometric shape at least one of the base edge lengths of the first plurality is different from all of the base edge lengths of the second plurality of base edge lengths, **[and] wherein the production tool is a coating roll, and wherein each of the cavities has a single opening**; and

forming the production tool using the design.

163. (AMENDED) A method of making a production tool, the method comprising:

creating a design for a production tool for manufacturing an abrasive article, the production tool comprising a first, second, and third plurality of cavities the first plurality of cavities each have a first geometric shape including a base and first plurality of base edge lengths forming the base of the geometric shape, the second plurality of cavities each have a second geometric shape including a base and second plurality of base edge lengths forming the base of the geometric shape, and the third plurality of cavities each have a third geometric shape including a base and third plurality of base edge lengths forming the base of the geometric shape at least one of the base edge lengths of the first plurality is different from all of the base edge lengths of the second and third plurality of base edge lengths at least one of the base edge lengths of the second plurality is different from all of the base edge lengths of the first and third plurality of base edge lengths, **[and] wherein the production tool is a coating roll, and wherein each of the cavities has a single opening**; and

forming the production tool using the design.

164. (AMENDED) A method of making a production tool, the method comprising:

creating a design for a production tool for manufacturing an abrasive article, the production tool comprising a first, second, third, and fourth plurality of cavities the first plurality of cavities each have a first geometric shape including a base and first plurality of base edge lengths forming the base of the geometric shape, the second plurality of cavities each have a second geometric shape including a base and second plurality of base edge lengths forming the base of the geometric shape, the third plurality of cavities each have a third geometric shape including a base and third plurality of base edge lengths forming the base of the geometric shape, and the fourth plurality of cavities each have a fourth geometric shape including a base and fourth plurality of base edge lengths forming the base of the geometric shape at least one of the base edge lengths of the first plurality is different from all of the base edge lengths of the second, third, and fourth plurality of base edge lengths at least one of the base edge lengths of the second plurality is different from all of the base edge lengths of the first, third, and fourth plurality of base edge lengths at least one of the base edge lengths of the third plurality is different from all of the base edge lengths of the first, second, and fourth plurality of base edge lengths, **[and] wherein the production tool is a coating roll, and wherein each of the cavities has a single opening**; and

forming the production tool using the design.

165. (AMENDED) A method of making a production tool, the method comprising:

creating a design for a production tool for manufacturing an abrasive article, the production tool comprising a plurality of cavities the cavities each have dimensions defining the cavity, the dimensions including base edge lengths at least 10% of pairs of adjacent cavities have at least one base edge length different between the two cavities of the pair, **[and] wherein the production tool is a coating roll, and wherein each of the cavities has a single opening**; and

forming the production tool using the design.

166. (AMENDED) A method of making a production tool, the method comprising:  
creating a design for a production tool for manufacturing an abrasive article, the production tool comprising a plurality of cavities the cavities each have dimensions defining the cavity, the dimensions including base edge lengths at least 30% of pairs of adjacent cavities have at least one base edge length different between the two cavities of the pair, **[and]** wherein the production tool is a coating roll, **and wherein each of the cavities has a single opening**; and  
forming the production tool using the design.
167. (AMENDED) A method of making a production tool, the method comprising:  
creating a design for a production tool for manufacturing an abrasive article, the production tool comprising a plurality of cavities the cavities each have dimensions defining the cavity, the dimensions including base edge lengths at least 50% of pairs of adjacent cavities have at least one base edge length different between the two cavities of the pair, **[and]** wherein the production tool is a coating roll, **and wherein each of the cavities has a single opening**; and  
forming the production tool using the design.
168. (AMENDED) A method of making a production tool, the method comprising:  
creating a design for a production tool for manufacturing an abrasive article, the production tool comprising a plurality of cavities the cavities each have dimensions defining the cavity, the dimensions including base edge lengths at least two adjacent cavities have at least one base edge length different between the two cavities, **[and]** wherein the production tool is a coating roll, **and wherein each of the cavities has a single opening**; and  
forming the production tool using the design.
- ~~169. (AMENDED) A method of making a production tool, the method comprising:~~  
~~creating a design for a production tool for manufacturing an abrasive article, the production~~

tool comprising a first and second plurality of cavities the first plurality of cavities each have a first geometric shape including a base and first plurality of base edge lengths forming the base of the geometric shape and the second plurality of cavities each have a second geometric shape including a base and second plurality of base edge lengths forming the base of the geometric shape at least one of the base edge lengths of the first plurality is different from all of the base edge lengths of the second plurality of base edge lengths, **[and]** wherein the production tool is an engraved metal roll, **and wherein each of the cavities has a single opening;** and

forming the production tool using the design.

170. (AMENDED) A method of making a production tool, the method comprising:

creating a design for a production tool for manufacturing an abrasive article, the production tool comprising a first, second, and third plurality of cavities the first plurality of cavities each have a first geometric shape including a base and first plurality of base edge lengths forming the base of the geometric shape, the second plurality of cavities each have a second geometric shape including a base and second plurality of base edge lengths forming the base of the geometric shape, and the third plurality of cavities each have a third geometric shape including a base and third plurality of base edge lengths forming the base of the geometric shape at least one of the base edge lengths of the first plurality is different from all of the base edge lengths of the second and third plurality of base edge lengths at least one of the base edge lengths of the second plurality is different from all of the base edge lengths of the first and third plurality of base edge lengths, **[and]** wherein the production tool is an engraved metal roll, **and wherein each of the cavities has a single opening;** and

forming the production tool using the design.

171. (AMENDED) A method of making a production tool, the method comprising:

creating a design for a production tool for manufacturing an abrasive article, the production tool comprising a first, second, third, and fourth plurality of cavities the first plurality of cavities each have a first geometric shape including a base and first plurality of base edge lengths forming the

base of the geometric shape, the second plurality of cavities each have a second geometric shape including a base and second plurality of base edge lengths forming the base of the geometric shape, the third plurality of cavities each have a third geometric shape including a base and third plurality of base edge lengths forming the base of the geometric shape, and the fourth plurality of cavities each have a fourth geometric shape including a base and fourth plurality of base edge lengths forming the base of the geometric shape at least one of the base edge lengths of the first plurality is different from all of the base edge lengths of the second, third, and fourth plurality of base edge lengths at least one of the base edge lengths of the second plurality is different from all of the base edge lengths of the first, third, and fourth plurality of base edge lengths at least one of the base edge lengths of the third plurality is different from all of the base edge lengths of the first, second, and fourth plurality of base edge lengths, **[and] wherein the production tool is an engraved metal roll, and wherein each of the cavities has a single opening**; and

forming the production tool using the design.

172. (AMENDED) A method of making a production tool, the method comprising:

creating a design for a production tool for manufacturing an abrasive article, the production tool comprising a plurality of cavities the cavities each have dimensions defining the cavity, the dimensions including base edge lengths at least 10% of pairs of adjacent cavities have at least one base edge length different between the two cavities of the pair, **[and] wherein the production tool is an engraved metal roll, and wherein each of the cavities has a single opening**; and

forming the production tool using the design.

173. (AMENDED) A method of making a production tool, the method comprising:

creating a design for a production tool for manufacturing an abrasive article, the production tool comprising a plurality of cavities the cavities each have dimensions defining the cavity, the

~~dimensions including base edge lengths at least 30% of pairs of adjacent cavities have at least one~~

base edge length different between the two cavities of the pair, **[and]** wherein the production tool is an engraved metal roll, **and wherein each of the cavities has a single opening**; and forming the production tool using the design.

174. (AMENDED) A method of making a production tool, the method comprising:  
creating a design for a production tool for manufacturing an abrasive article, the production tool comprising a plurality of cavities the cavities each have dimensions defining the cavity, the dimensions including base edge lengths at least 50% of pairs of adjacent cavities have at least one base edge length different between the two cavities of the pair, **[and]** wherein the production tool is an engraved metal roll, **and wherein each of the cavities has a single opening**; and forming the production tool using the design.

175. (AMENDED) A method of making a production tool, the method comprising:  
creating a design for a production tool for manufacturing an abrasive article, the production tool comprising a plurality of cavities the cavities each have dimensions defining the cavity, the dimensions including base edge lengths at least two adjacent cavities have at least one base edge length different between the two cavities, **[and]** wherein the production tool is an engraved metal roll, **and wherein each of the cavities has a single opening**; and forming the production tool using the design.